Manganese Treatment in Groundwater Supplies

Case Studies

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Why remove manganese?

Potlotek First Nation advised its water unfit for drinking or washing

High levels of iron and manganese exceed 'esthetic objectives' for water quality

Still no timeline for manganese relief in St. John's

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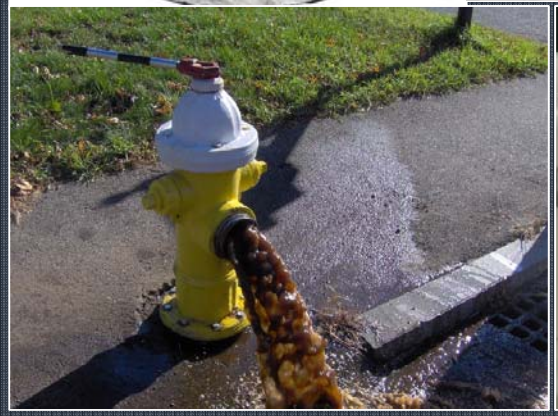
Pending Health Canada Guidelines

- AO 0.02 mg/L
- MAC 0.1 mg/L

Impacts of Manganese for Municipal Systems

- Discoloration
- Biofilm
- Health
- Customer Acceptance
- Regulatory Compliance



Treatment Applications

- Surface Water
- Municipal Groundwater
- Private/Registered Groundwater

Source/Treatment Categories

- No source Mn, no need for treatment
- Source water Mn occurrence, no present treatment
- Source water Mn occurrence, existing Mn treatment with limited performance
- Source water Mn occurrence, fully compliant existing Mn treatment (<0.02mg/L)

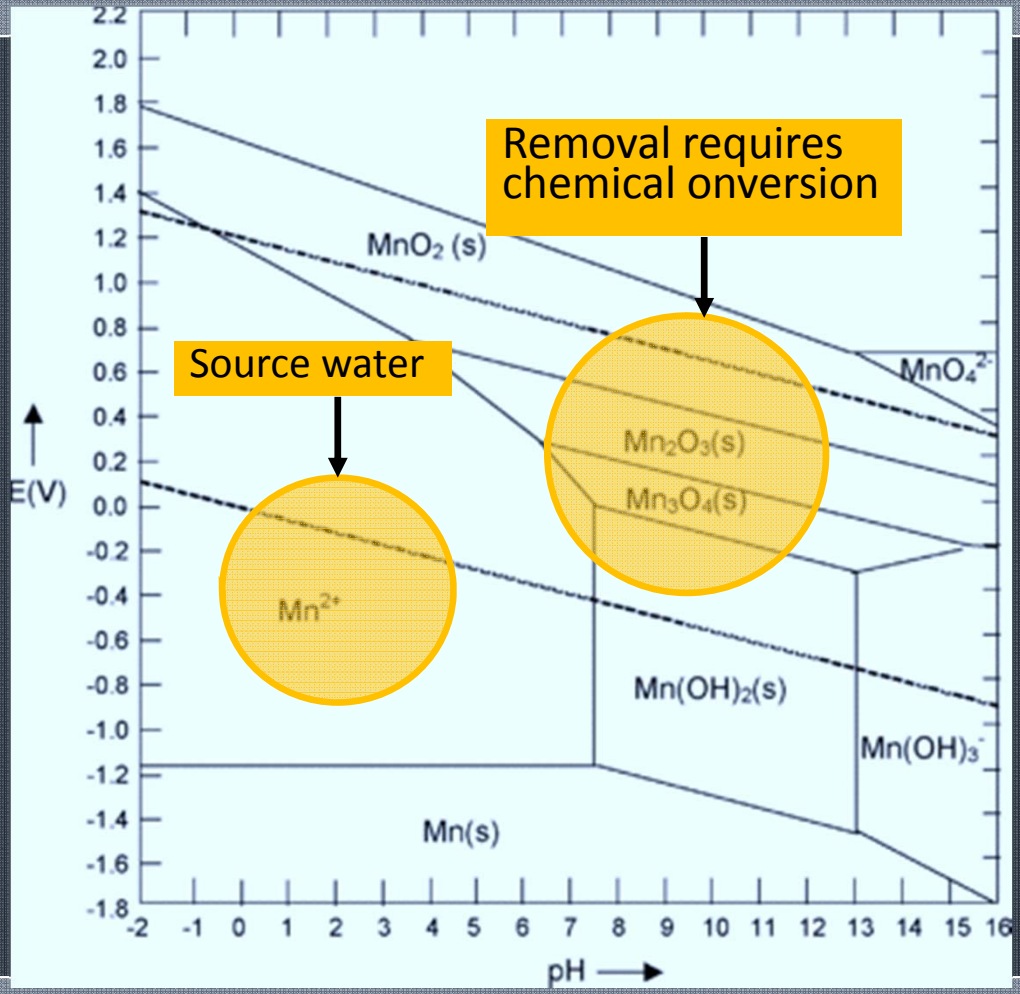
Testing & Analysis

- In-plant operational testing
  - Hach method
- Certified lab testing
  - Costly, infrequent, and not operationally useful
- Emerging technology

- Total vs Dissolved vs “Reactive” Mn

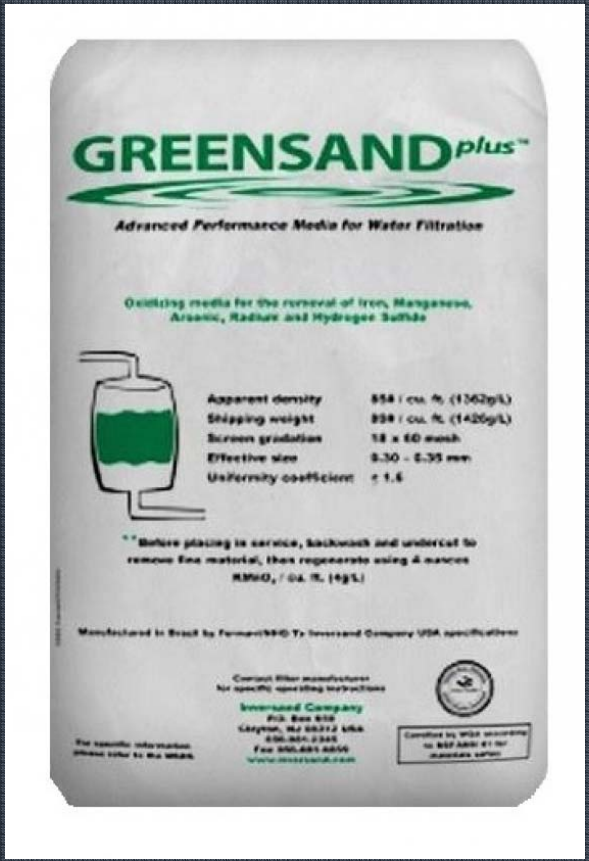
Mn Oxidation

- pH (higher is better)
- HRT (longer – surface water)
- Oxidant (air→Cl_2→$KMnO_4$→ O_3)



Iron and Manganese Removal

- Sequestration
- Greensand filtration
- Pre-oxidation with filtration
  - Air
  - Chlorine
  - Ozone
  - Permanganate
- Membrane treatment
- Biological treatment



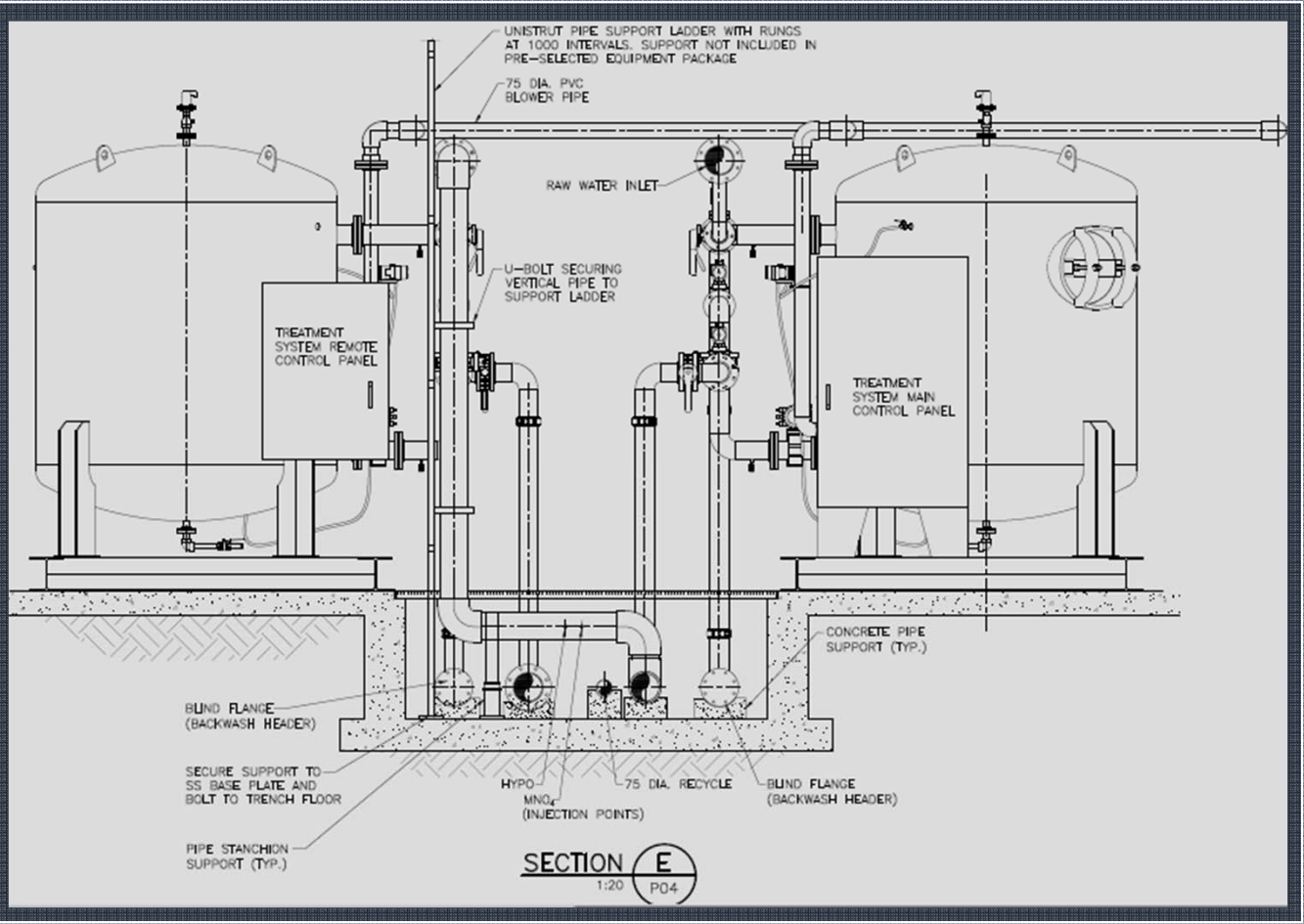
Groundwater Mn Treatment – Atlantic Canada

Plant	Mn Strategy
CBRM (Sydney)	Oxidative Media
Fredericton	Oxidative Media
Pugwash	Biological Filtration
Pictou	Oxidative Media
Louisdale	Coagulation/Oxidative Media
Rothesay	Oxidation/Membrane Filtration
Dorchester	Biological Filtration
Memramcook	Biological Filtration
Shediac	Biological Filtration
Woodstock	Biological Filtration
Sipekne'katik	Oxidative Media
Goose Bay	Coagulation/Oxidative Media

Municipal Groundwater Treatment

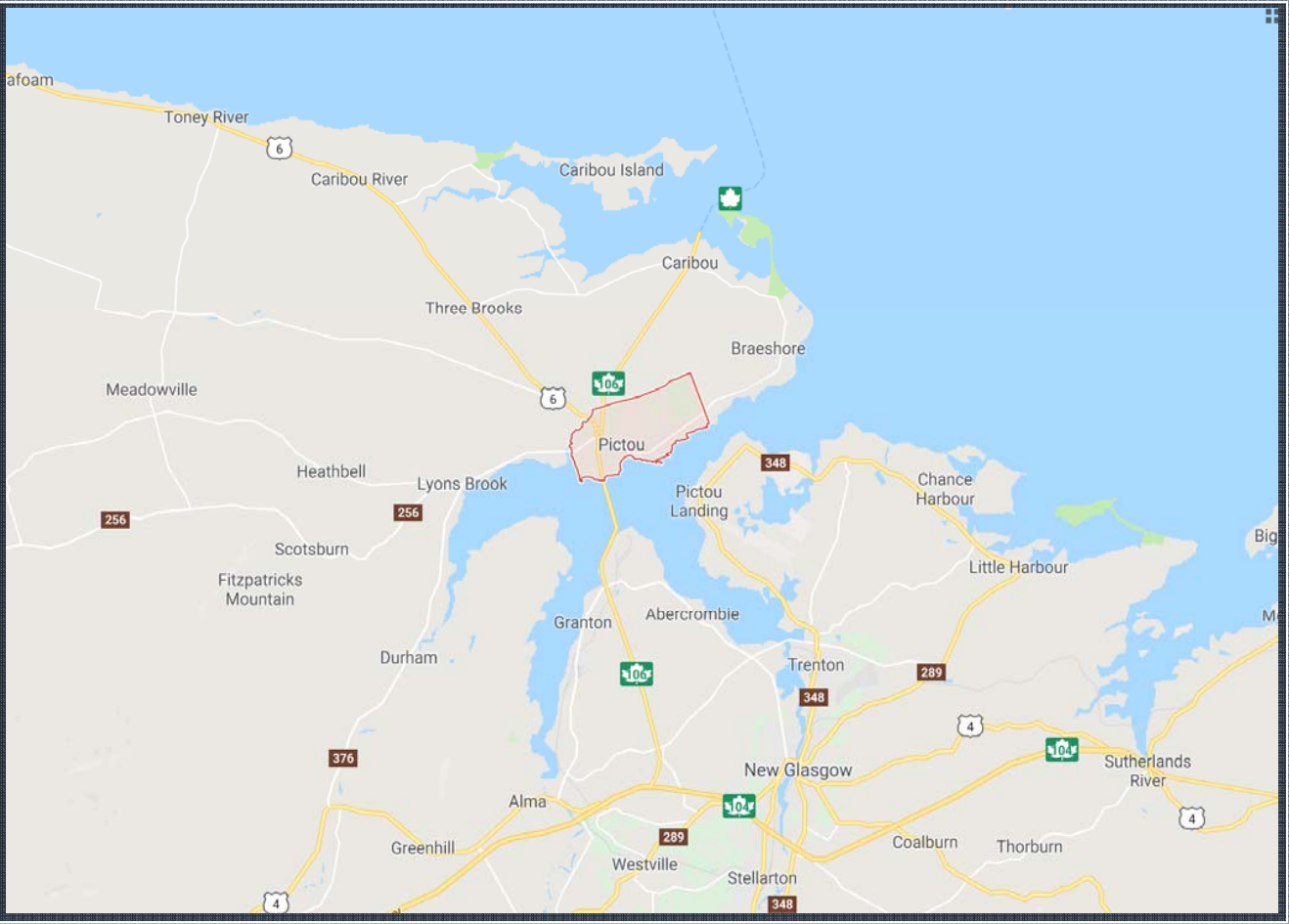
- Oxidation & media filtration
- Coagulation/oxidation & media filtration
- Biological filtration

- NS examples:
  - Pictou
  - Louisdale
  - Pugwash

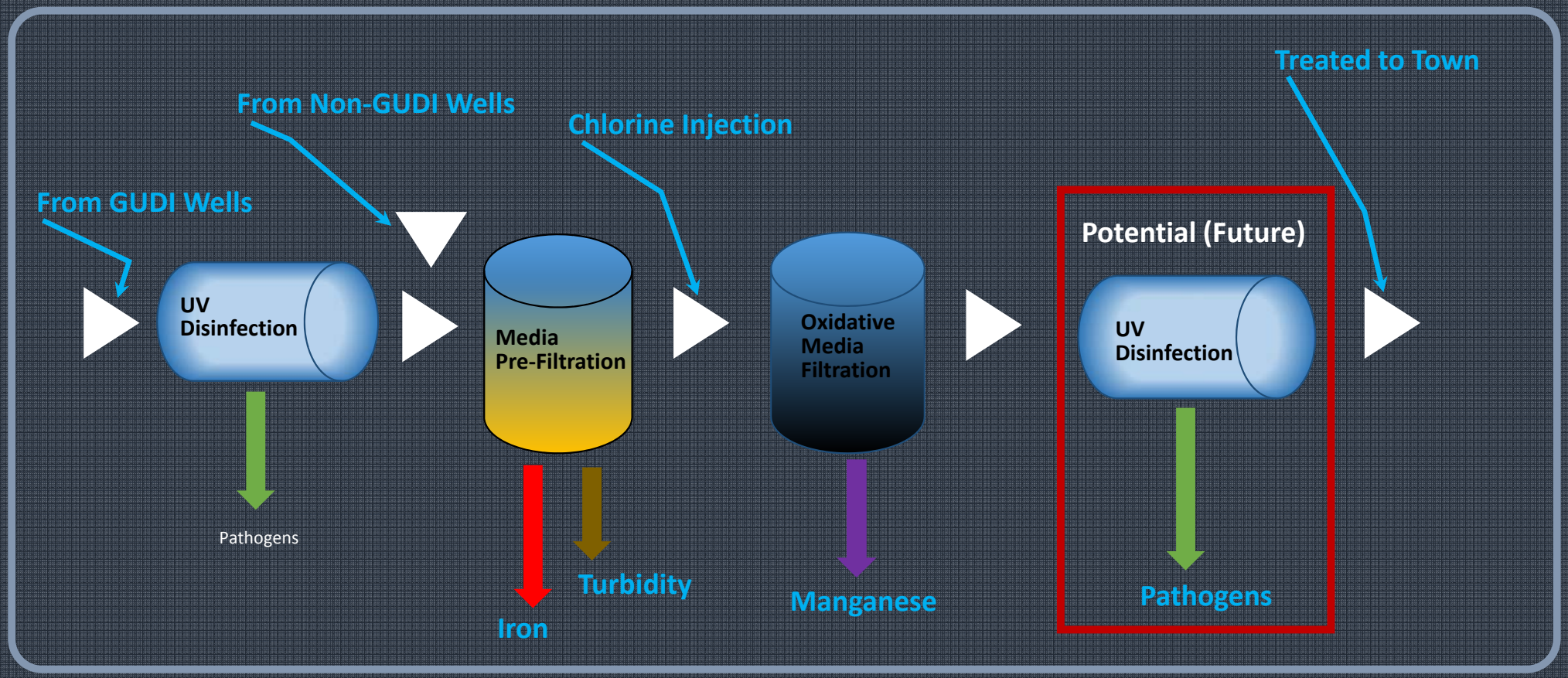


Pictou WTP

- Service base of 3,200 ppl
- 14 wells supply water individually
- Standpipe
- One pressure zone
- Varying quality by well
  - Iron
  - Manganese
  - Turbidity
  - GUDI
- WTP Project ($3.1M)
  - New WTP (550 gpm)
  - Wellhead Upgrades
  - Pressure Zones



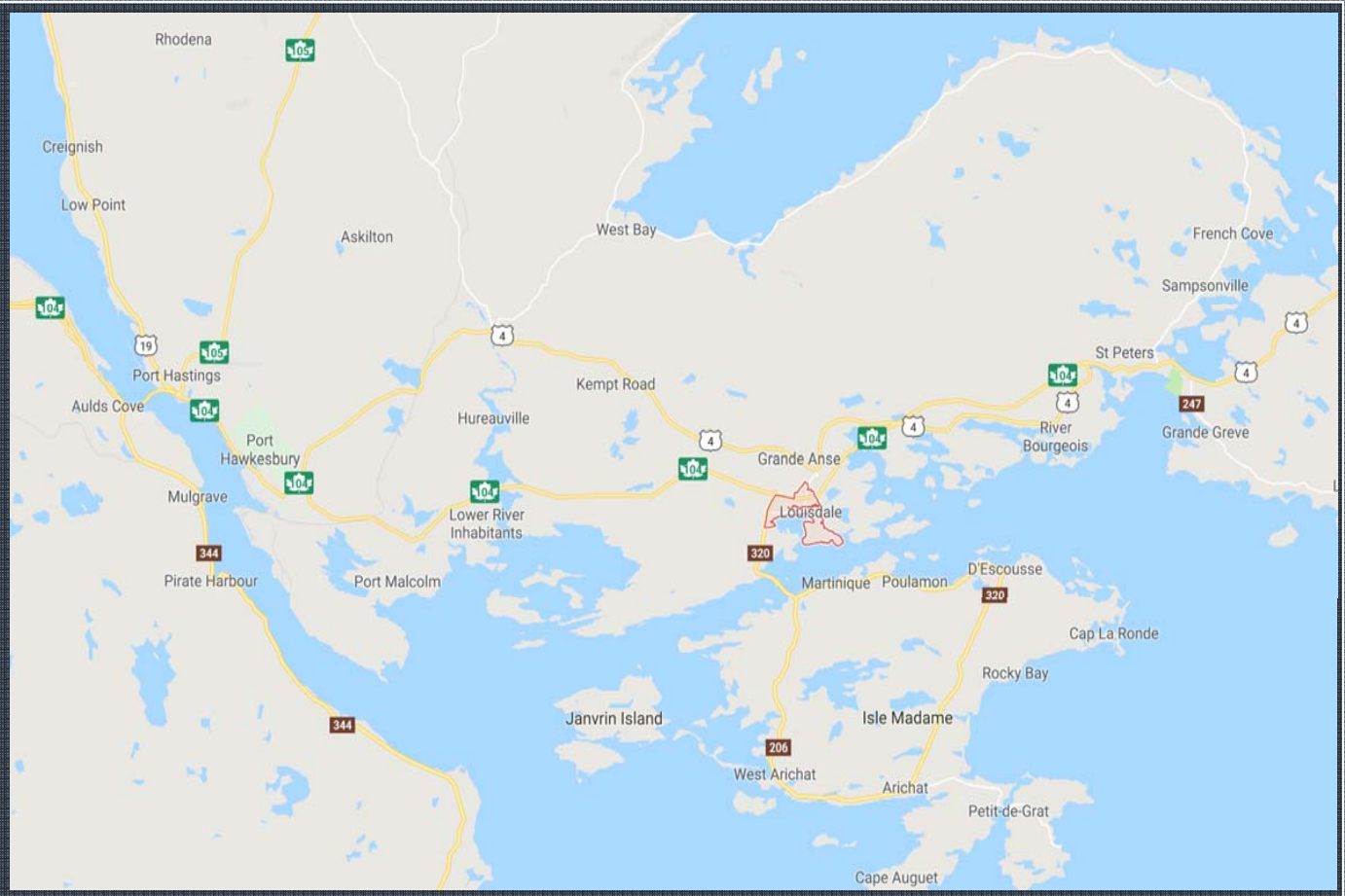
Chemical Oxidation and Filtration - Pictou



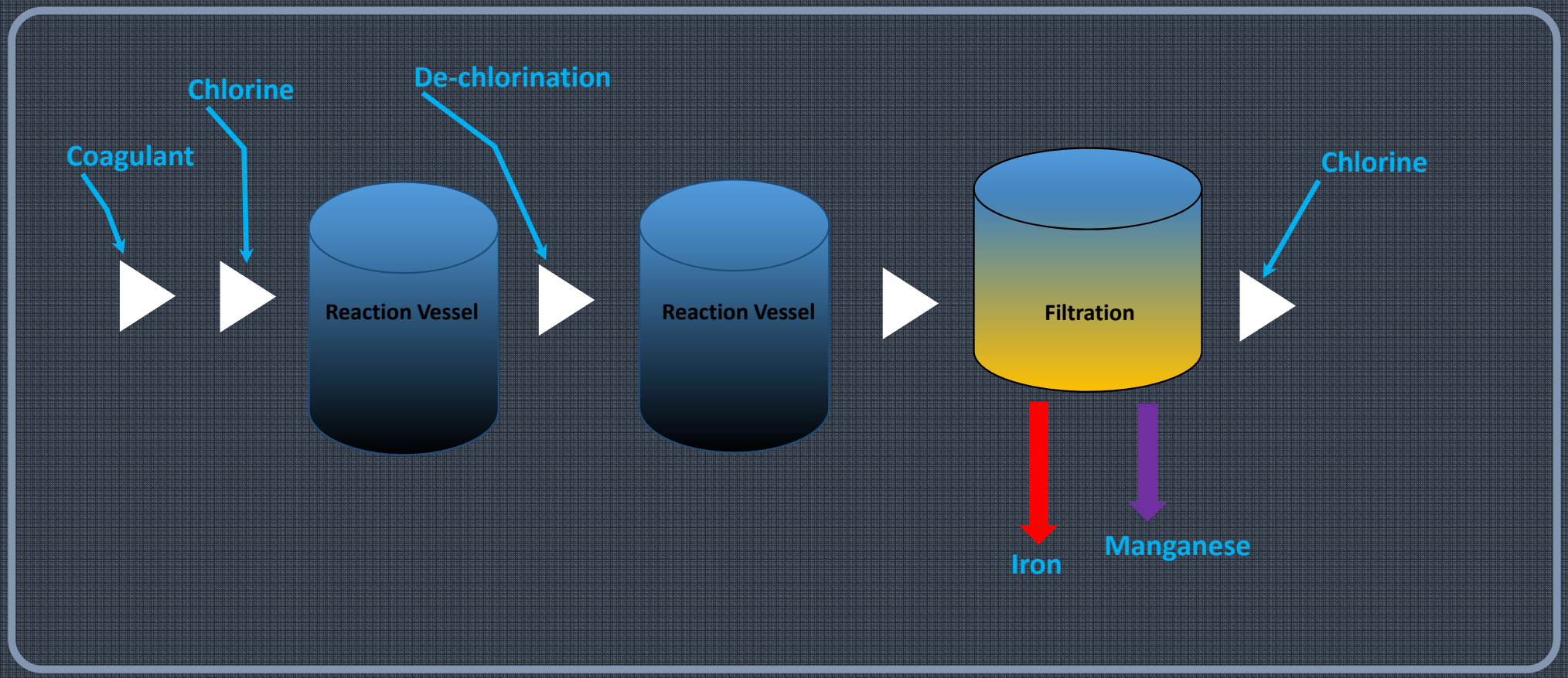
Pictou WTP

Louisdale WTP

- Service base of 2,000 ppl serving 3 communities
- Long distribution system
- Prior switch from surface to groundwater
- WTP Project ($2.1M)
  - New WTP (342 gpm)
  - Residuals disposal



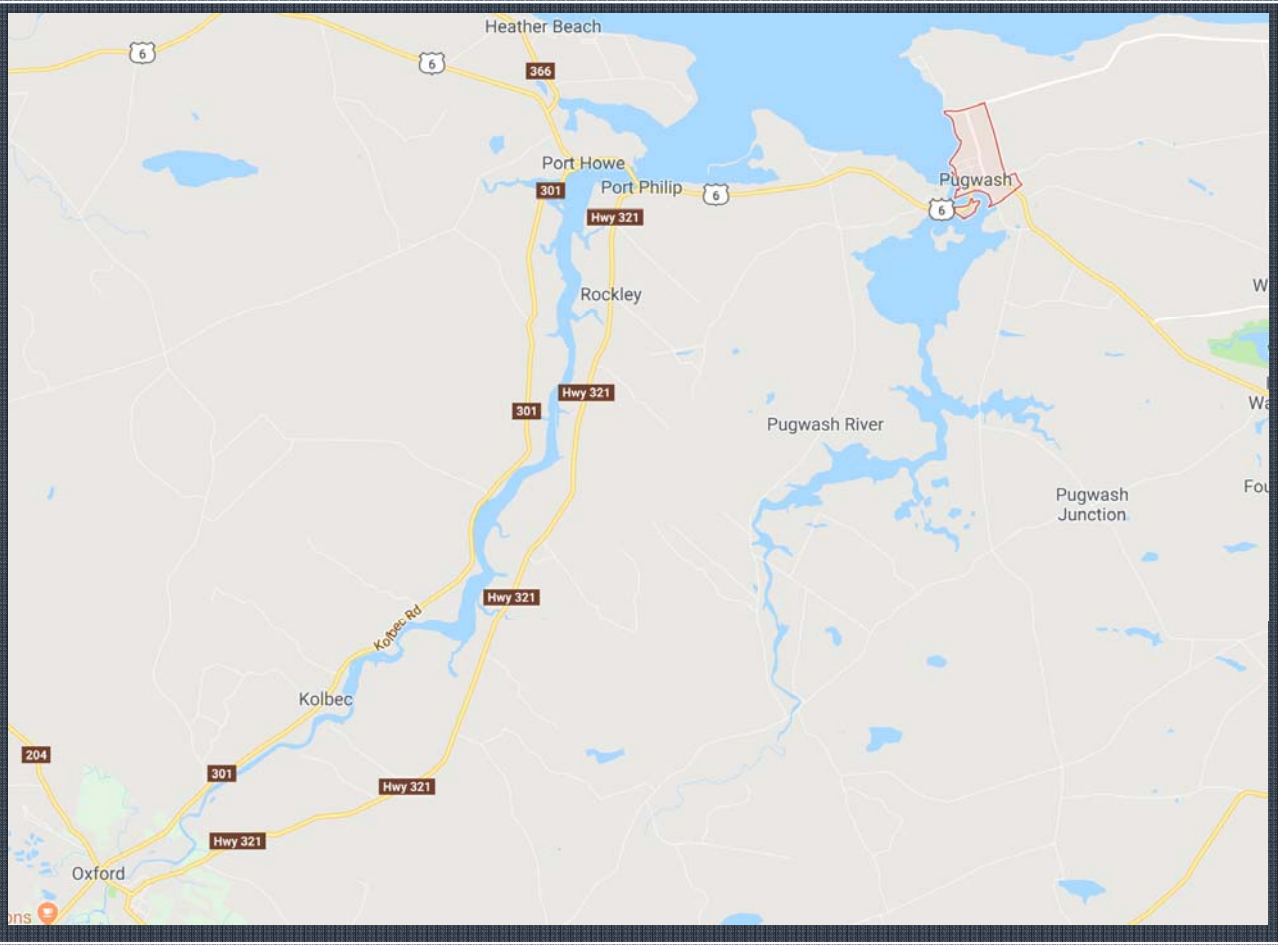
Chemical Oxidation and Filtration - Louisdale



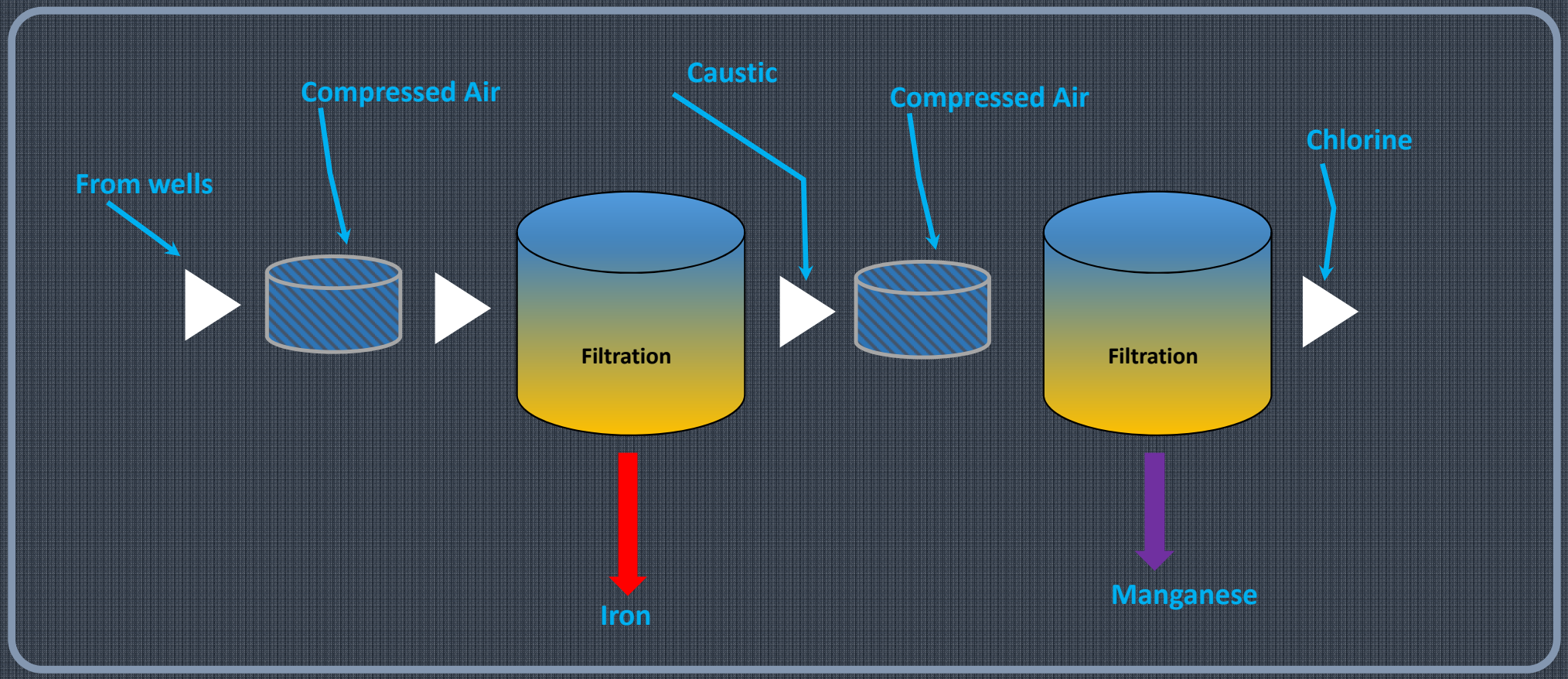
Louisdale WTP

Pugwash WTP

- Service base of 1,000 ppl (350 connections)
- 3 new wells
- No existing infrastructure
- WTP Project ($1.5M)
  - Well Development
  - New WTP (150 gpm)
  - Standpipe
  - Transmission Main



Biological Filtration - Pugwash



Pugwash WTP

Comparison

Oxidative Media

- Robust for variable water quality
- Single chemical application

Chemical Precipitation

- Economical
- Can remove Fe, Mn and organic matter in one step

Biological Filtration

- Lowest chemical use
- Reduced requirements for backwashing

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Consulting Engineers

Questions